Madden-Julian Oscillation:
Recent Evolution, Current Status and Predictions

Update prepared by the Climate Prediction Center
Climate Prediction Center / NCEP
13 June 2022

Overview

- During the past week, the RMM index indicates a weakened and less coherent intraseasonal signal over the Western Hemisphere, which is also reflected in the latest upper-level velocity potential fields.

- Dynamical model RMM forecasts feature an uptick in amplitude, followed by a re-weakening of the signal by early week-2, with reduced ensemble support for a coherent MJO later in June.

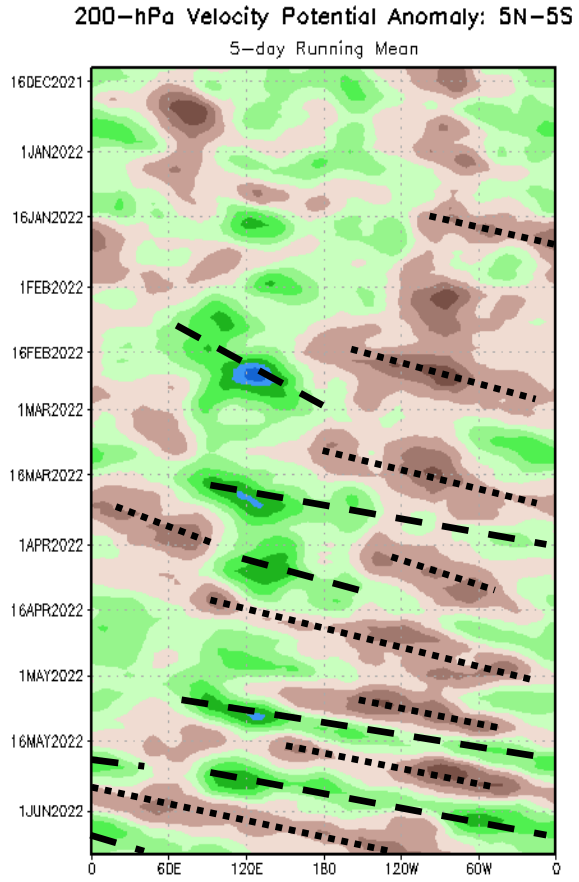
- Regardless of a more disorganized MJO in the outlook, Rossby wave activity, as well as anomalous lower-level westerlies favored over the Western Hemisphere is anticipated to contribute to tropical cyclone (TC) formation in the Eastern Pacific and Atlantic basin during the next two weeks.

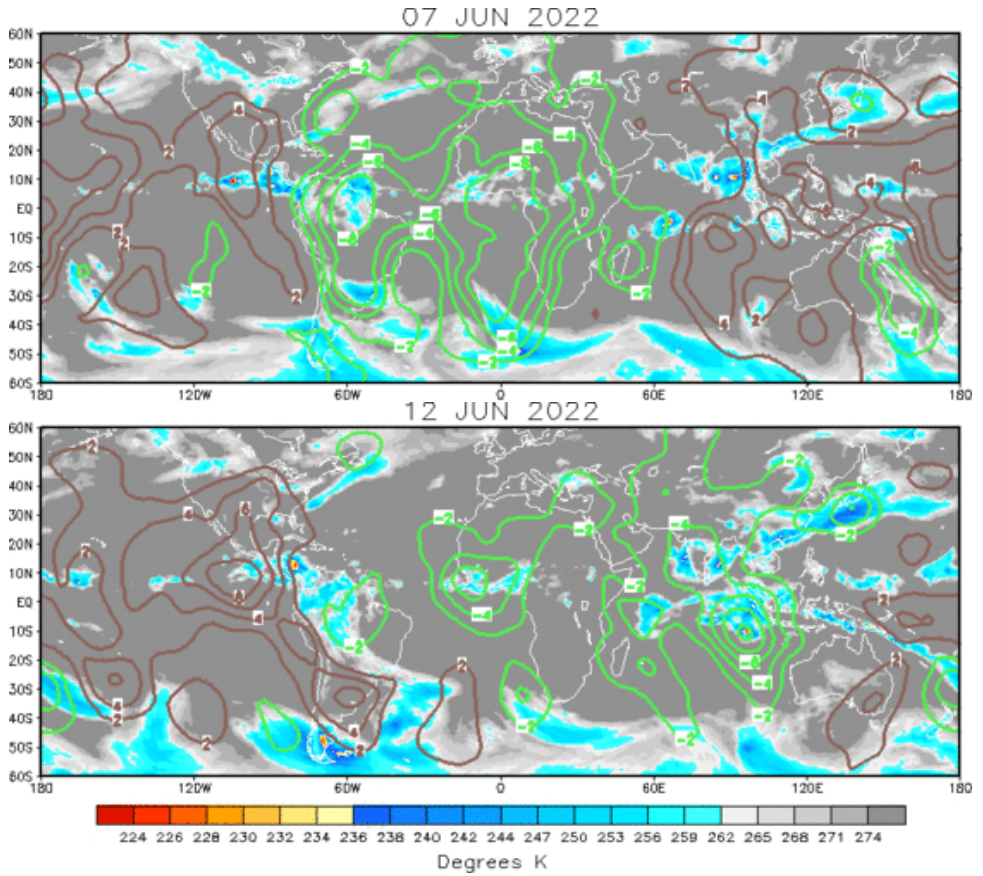
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation)

Brown shades: Anomalous convergence (unfavorable for precipitation)

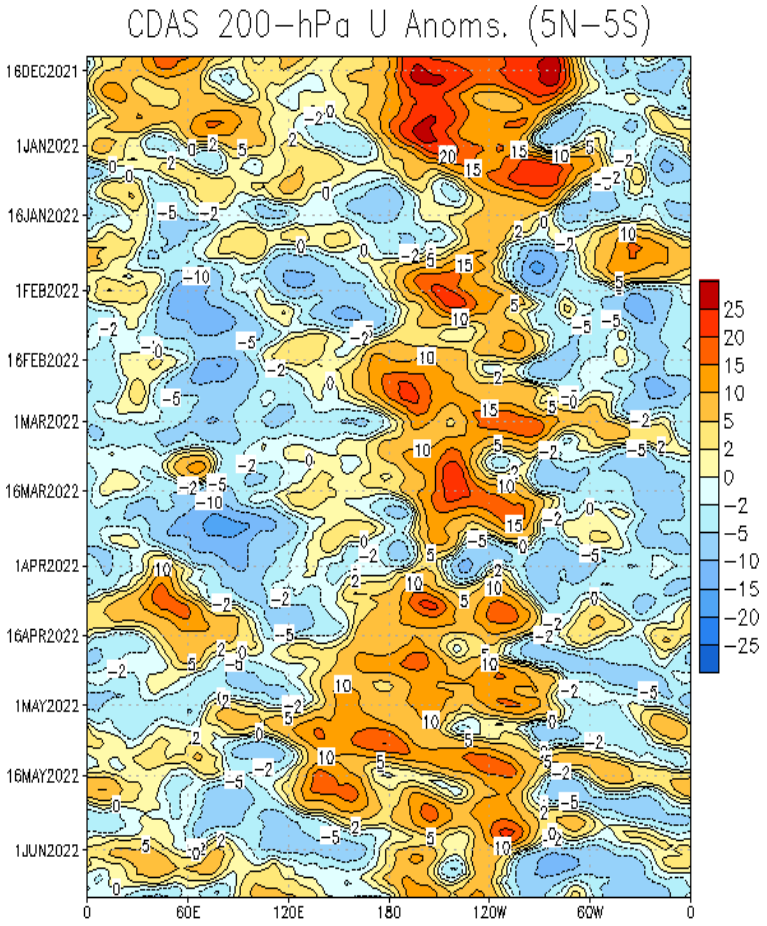


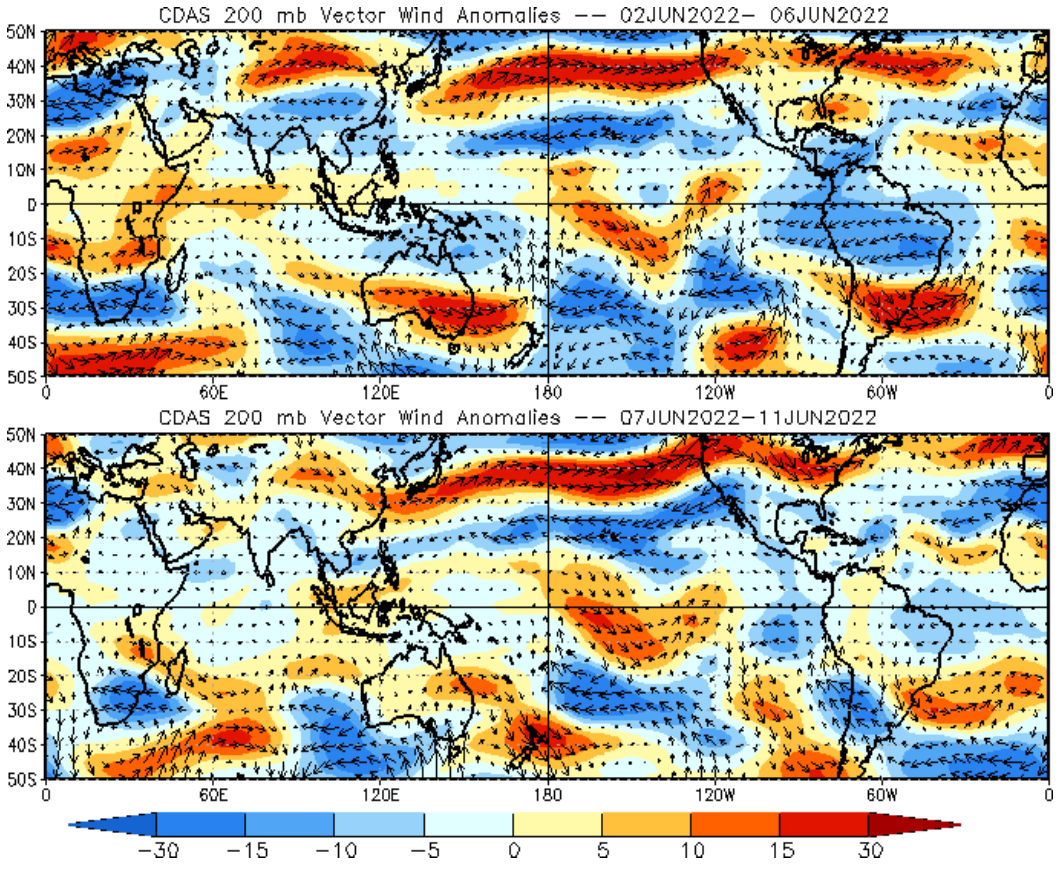


- Upper-level velocity potential anomalies have weakened from a coherent wave-1 pattern since last week.
- However, envelopes of anomalous divergence (convergence) aloft have continued to shift eastward, where the leading edges are currently observed over the Indian Ocean (Americas).

200-hPa Wind Anomalies

Shading denotes the zonal wind anomaly. Blue shades: Anomalous easterlies. Red shades: Anomalous westerlies.

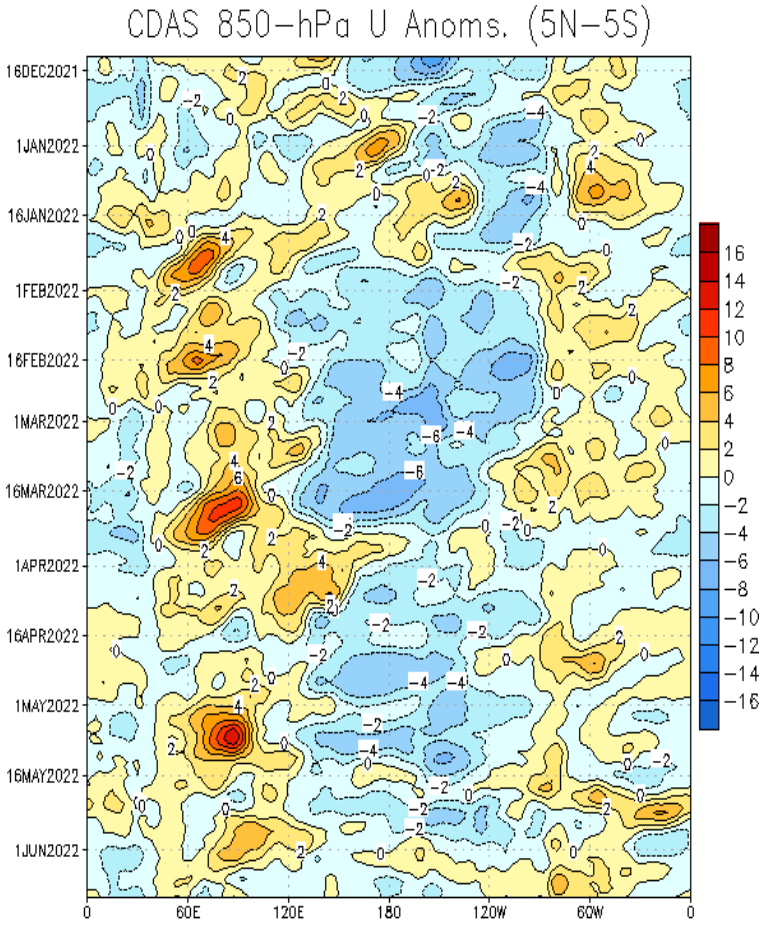


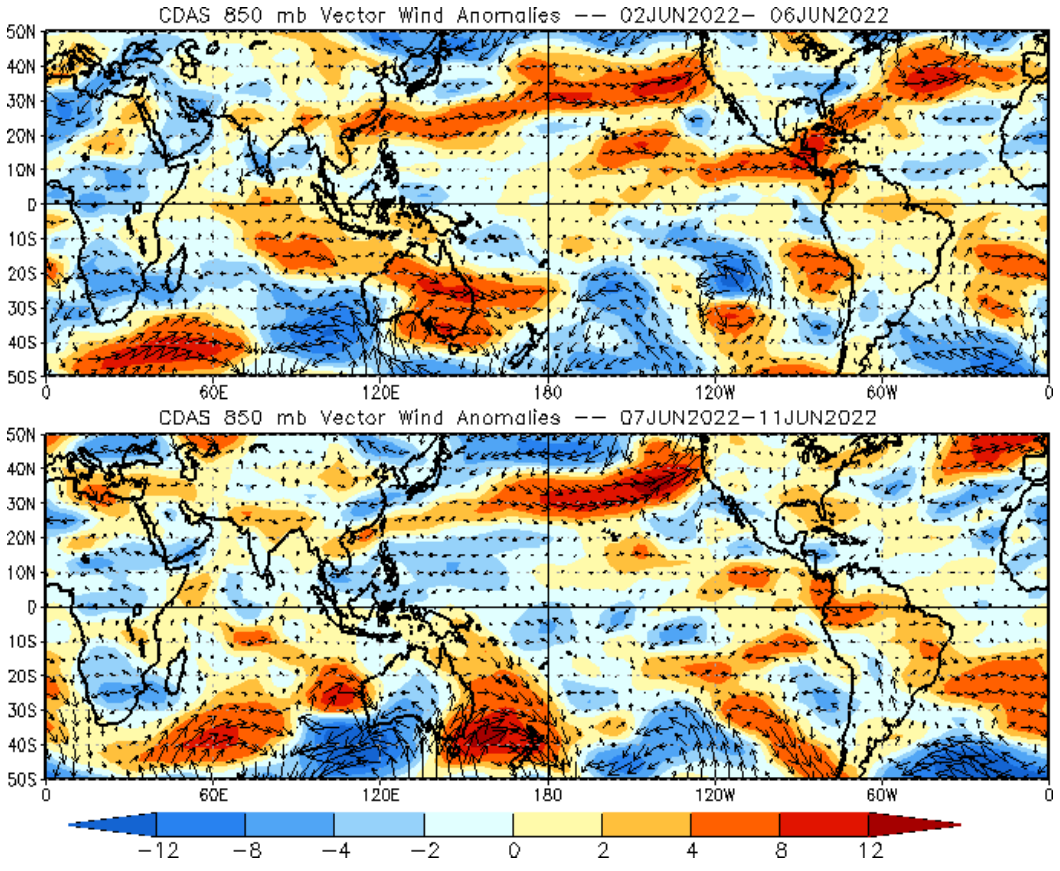


- Consistent with the ongoing La Nina, anomalous westerlies aloft persist over the equatorial Pacific. However, this low frequency footprint has become more zonally narrow since earlier this spring (recently limited from 120W to the Date Line).
- Rapidly eastward shifting westerly anomalies in the eastern Hemisphere are likely tied recent Kelvin wave activity since the start of June.

850-hPa Wind Anomalies

Shading denotes the zonal wind anomaly. Blue shades: Anomalous easterlies. Red shades: Anomalous westerlies.

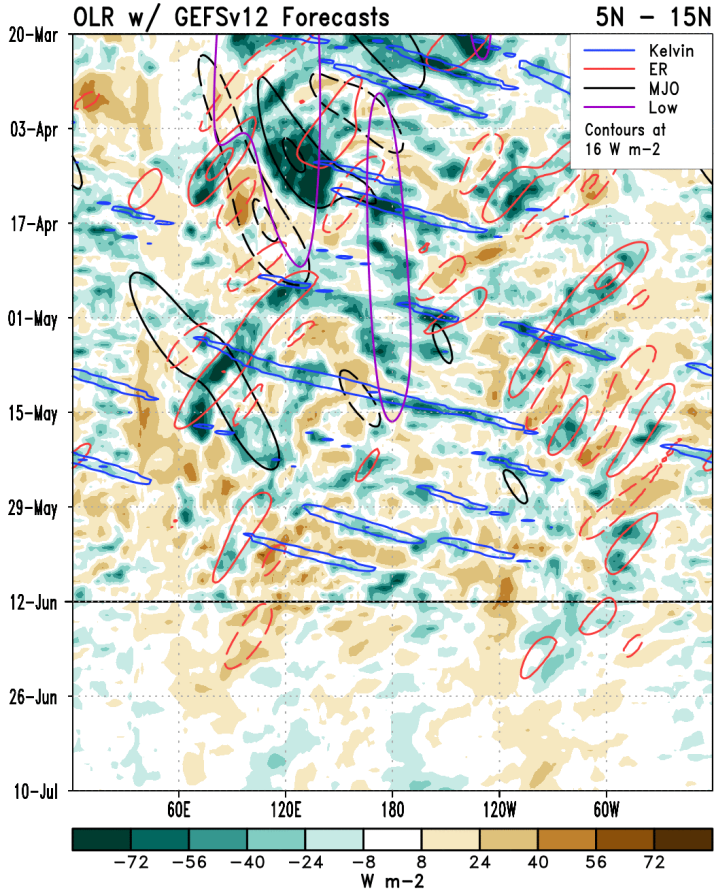


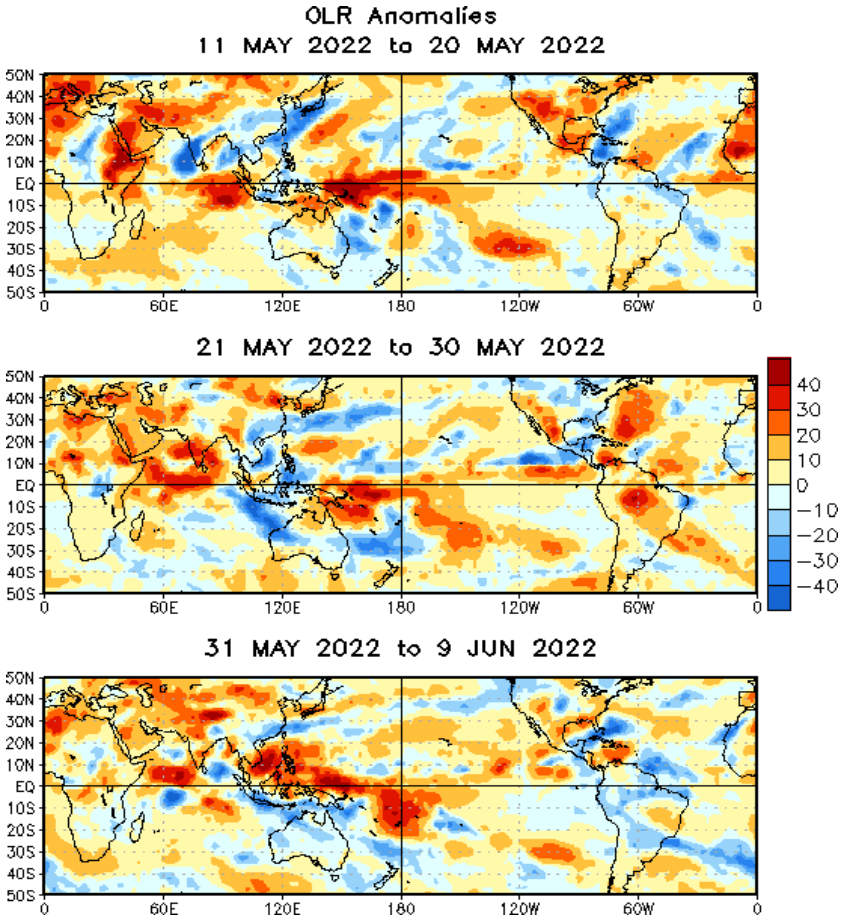


- Enhanced trades have returned over the central equatorial Pacific, with anomalous westerlies persisting across the eastern Pacific conducive for tropical cyclone activity.
- Anomalous westerlies have strengthened over the eastern Indian Ocean, as well as throughout the northern Pacific as part of a broad region of anomalous cyclonic flow.

Outgoing Longwave Radiation (OLR) Anomalies

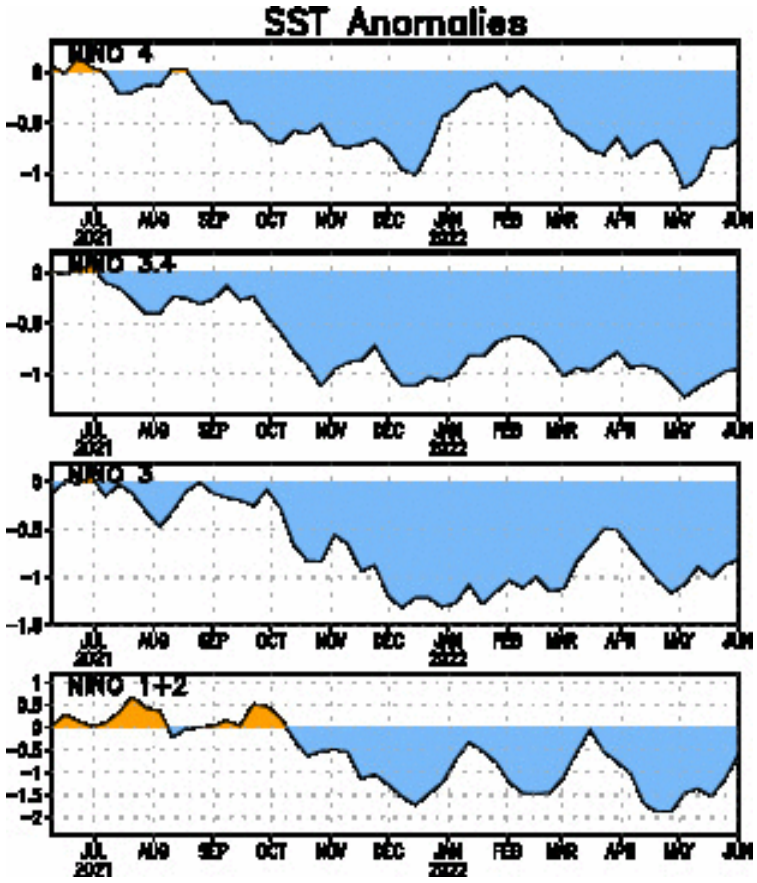
Green shades: Anomalous convection (wetness)
Brown shades: Anomalous subsidence (dryness)

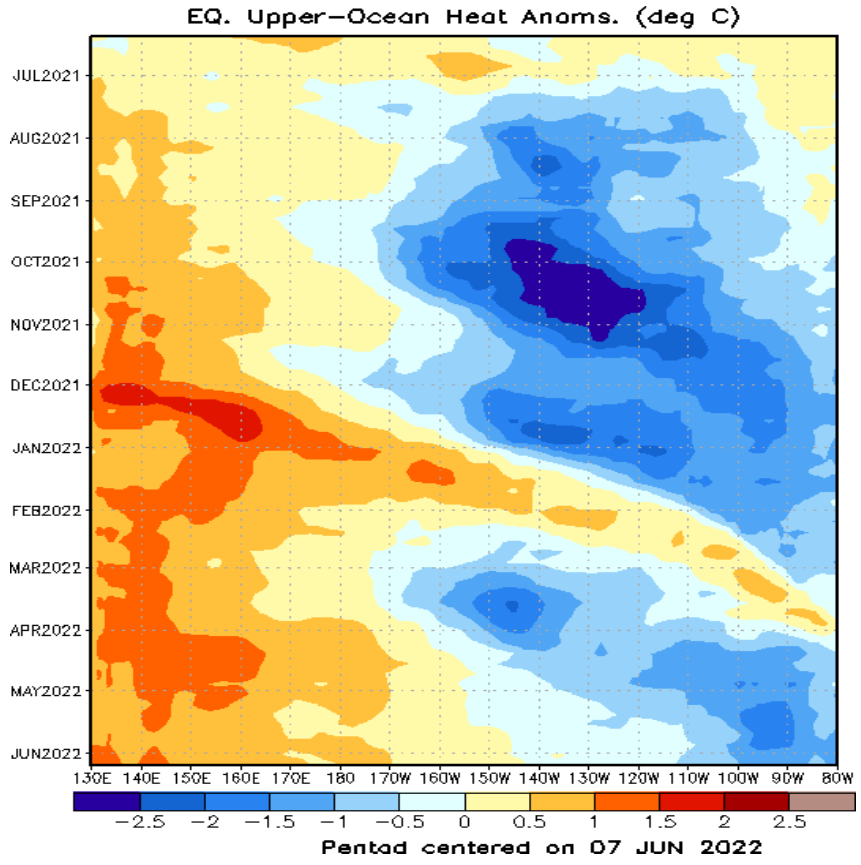




- Suppressed convection to the west and along the Date Line has remained the most predominant feature in the OLR field during the last several months, with much of this suppression expanding westward across the Maritime Continent during early June.
- OLR forecasts focused north of the equator are favoring enhanced convection and Rossby wave activity in the objective filtering between 120W and 60W.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

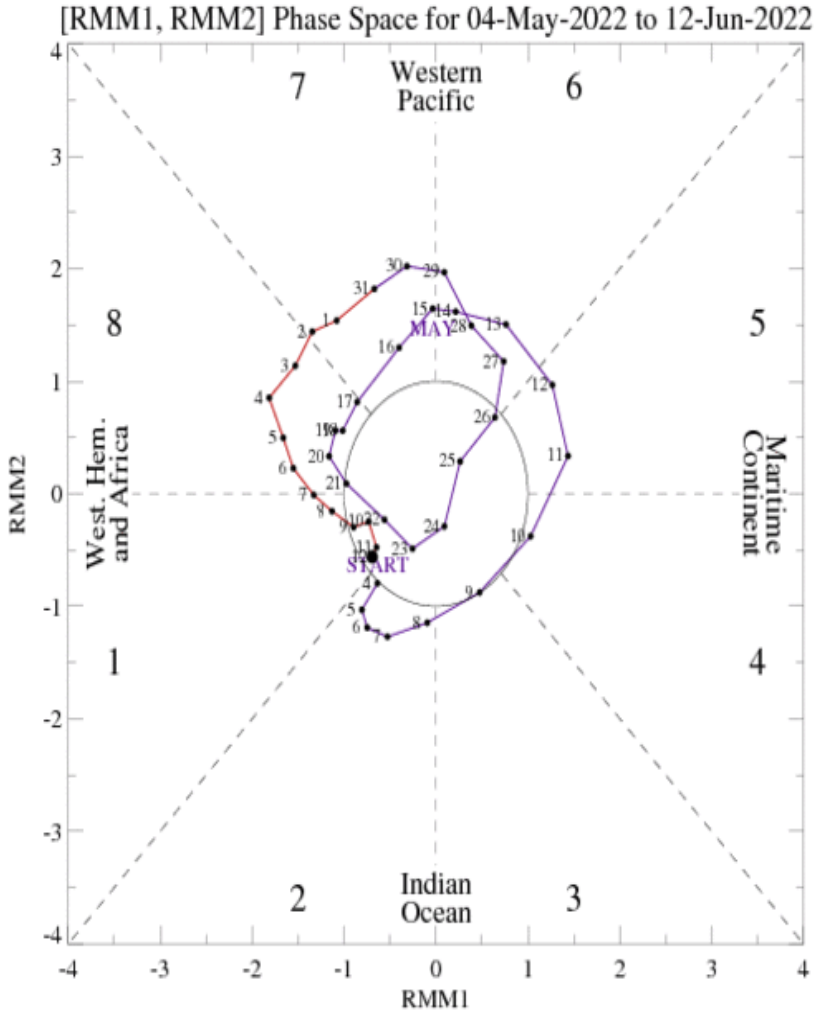




- Increased low level westerly wind bursts tied to Kelvin Wave activity has resulted in an increase in sea surface temperatures across the Niño Regions during the past several weeks, although anomalies remain largely negative.
- Positive subsurface temperature anomalies continue to the west of 150°W, though the eastward extent and magnitude of these anomalies are quite weaker compared to the downwelling event observed earlier in the year.

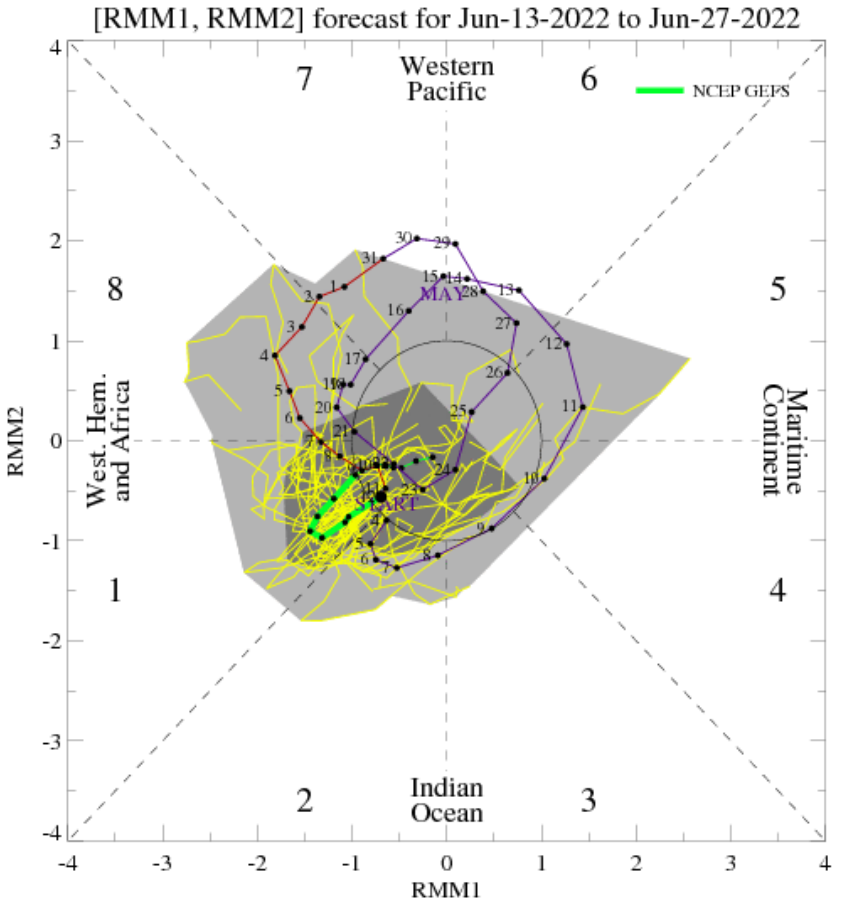
MJO Index: Recent Evolution

- Consistent with recent trends in the upper-level velocity potential anomaly fields, the RMM index indicates an eastward propagating signal, but has weakened over the western Hemisphere / Africa during the past seven days.

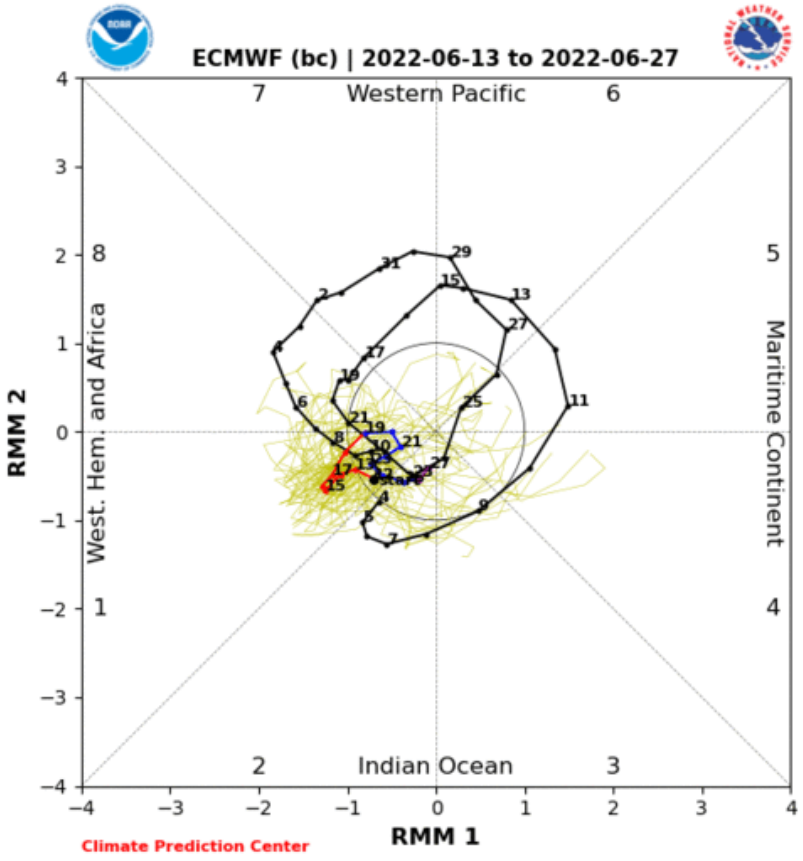


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast

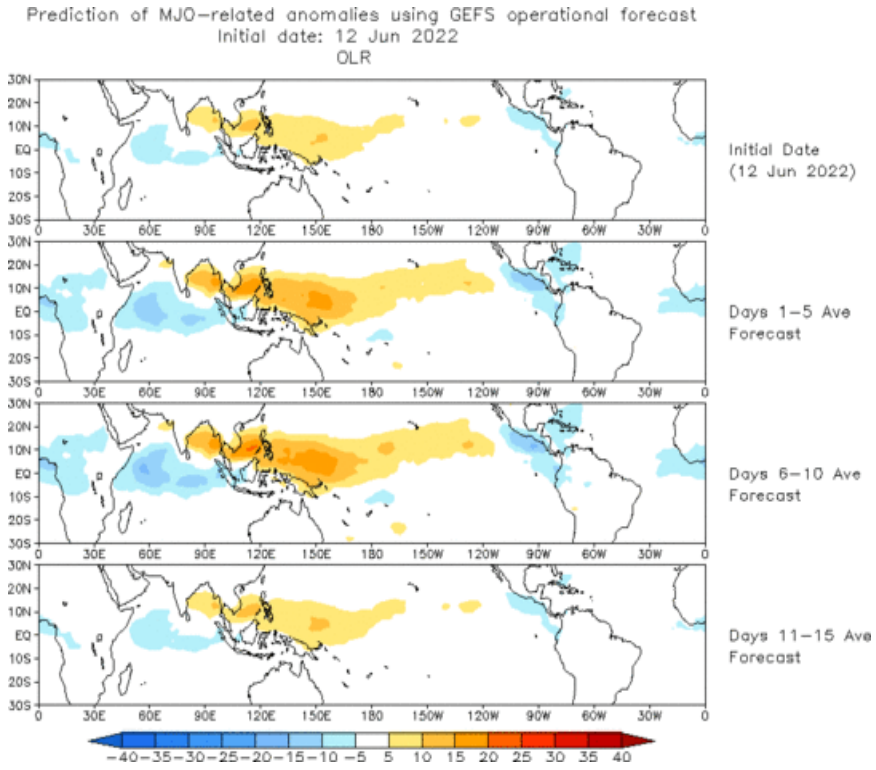


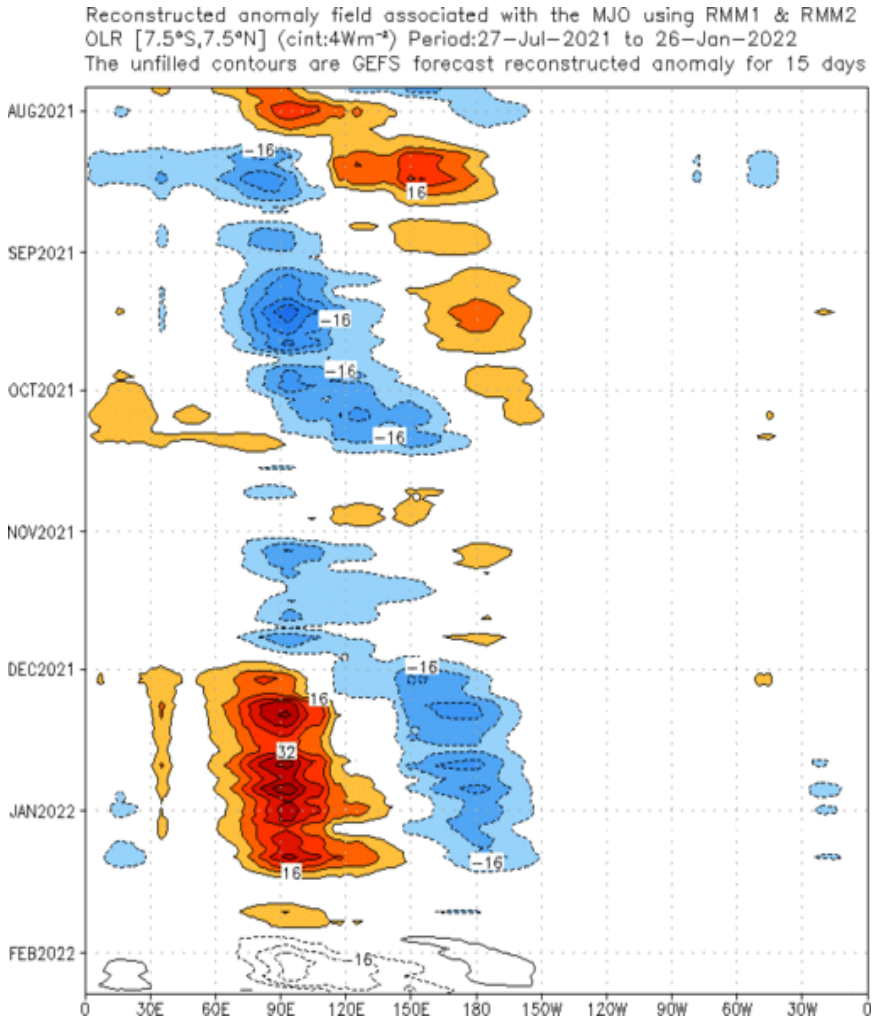
ECMWF Forecast

- There is good agreement between GEFS, ECMWF and JMA ensemble means favoring a re-strengthening of the signal, followed by a weakening over Africa by the start of week-2. While several members indicate continued eastward propagation, ensemble spread and uncertainty remains high later in June.
- The uptick in magnitude appears to be tied to predicted Rossby wave activity in the tropical western Hemisphere.

MJO: GEFS Forecast Evolution

Figures below show MJO associated OLR anomalies only (reconstructed from RMM1 and RMM2) and do not include contributions from other modes (*i.e.*, ENSO, monsoons, etc.)

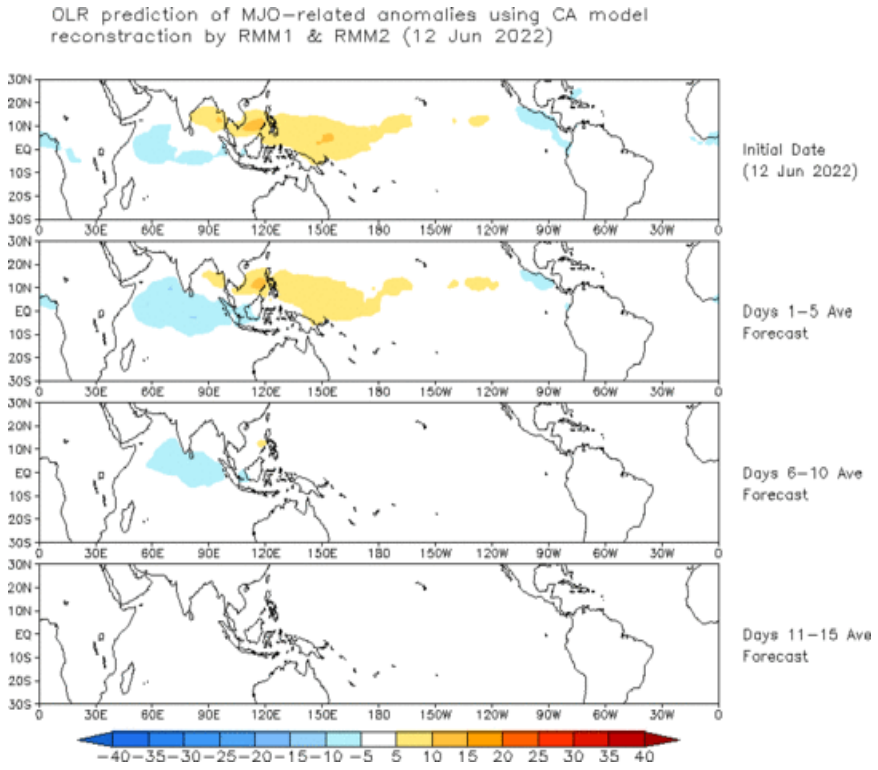


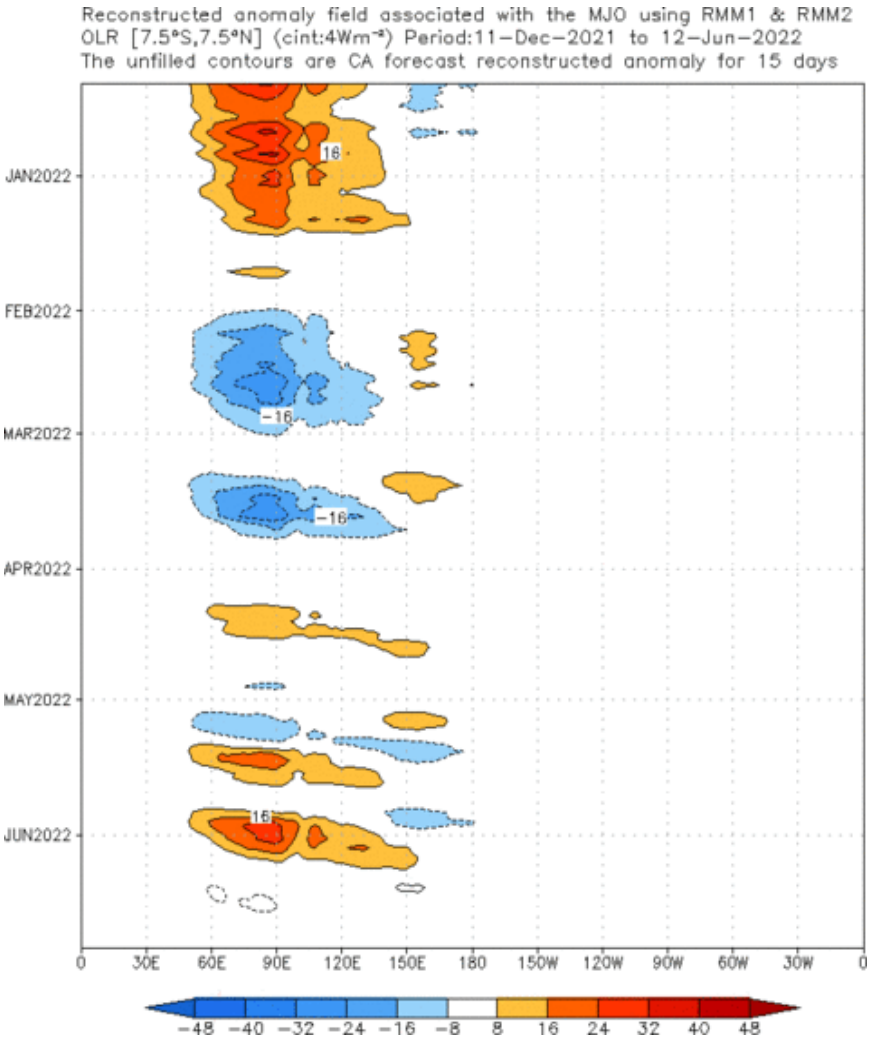


- Consistent with the RMM forecast, the GEFS favors a strengthening of enhanced convection from the Americas to the eastern Indian Ocean that weakens later in the outlook period.

MJO: Constructed Analog Forecast Evolution

Figures below show MJO associated OLR anomalies only (reconstructed from RMM1 and RMM2) and do not include contributions from other modes (*i.e.*, ENSO, monsoons, etc.)

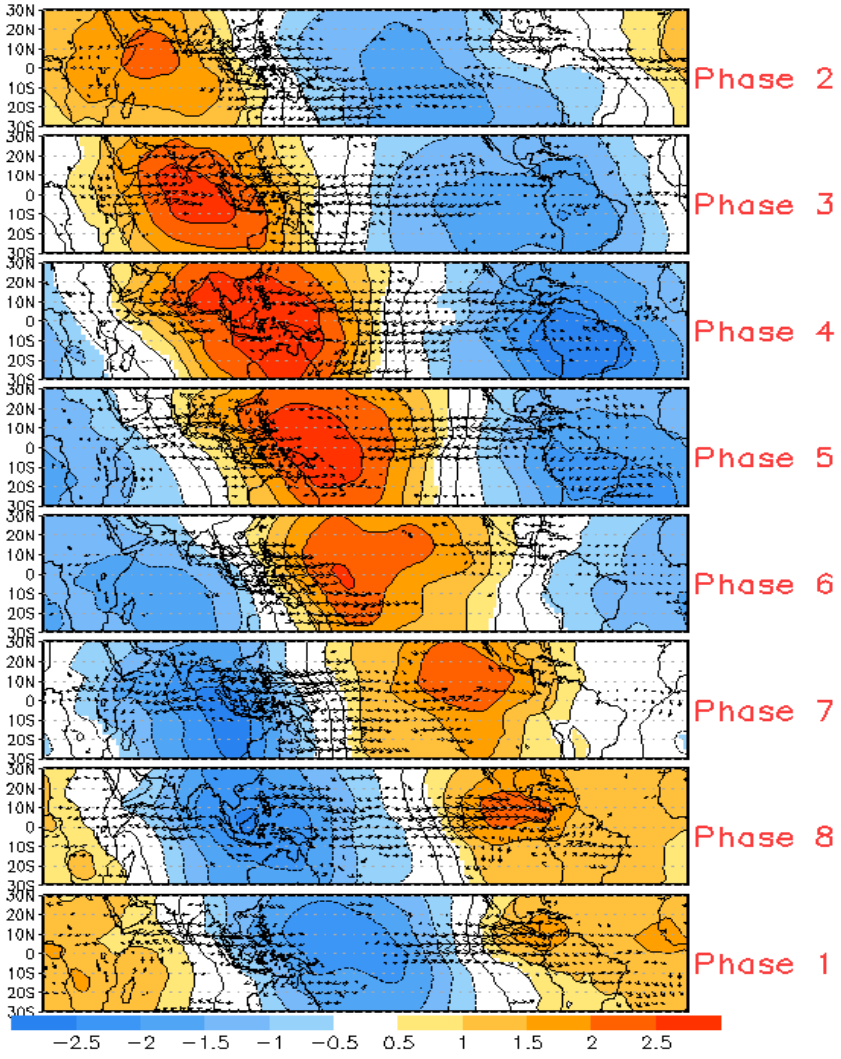




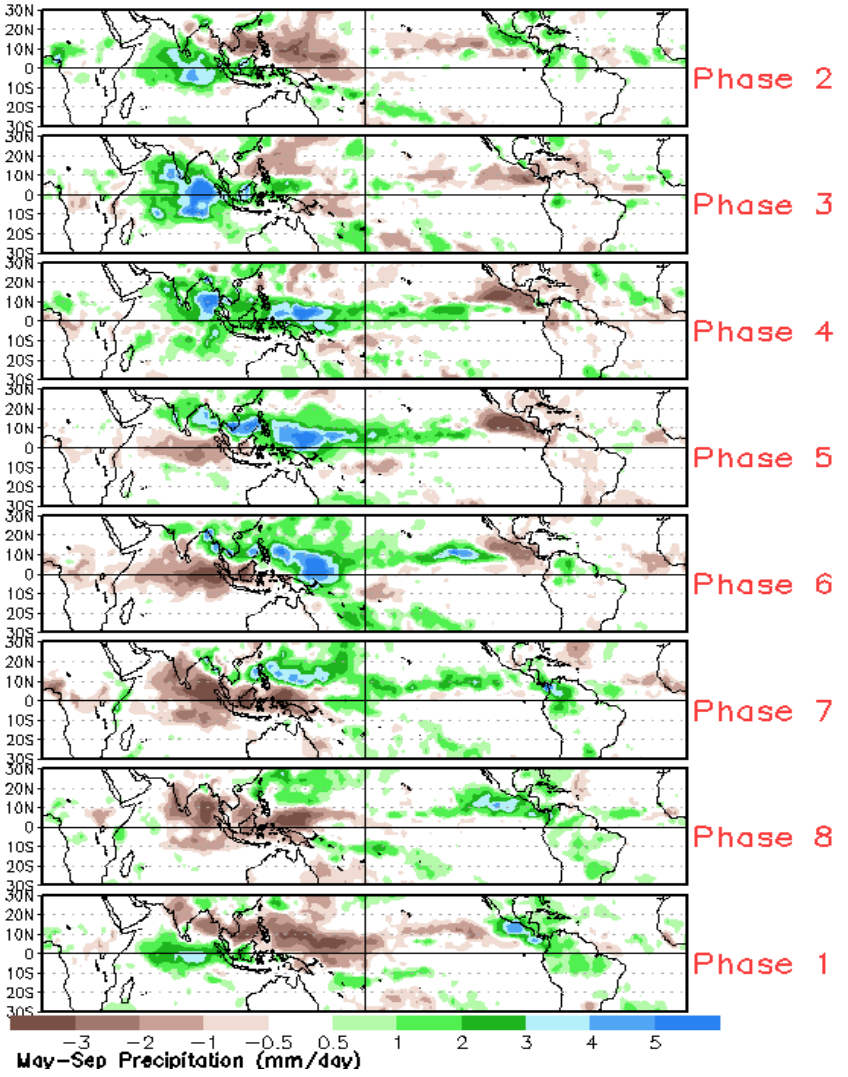
- The constructed analog forecast of RMM-based OLR anomalies is rather muted and unsupportive of a coherent MJO signal during the next two weeks.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



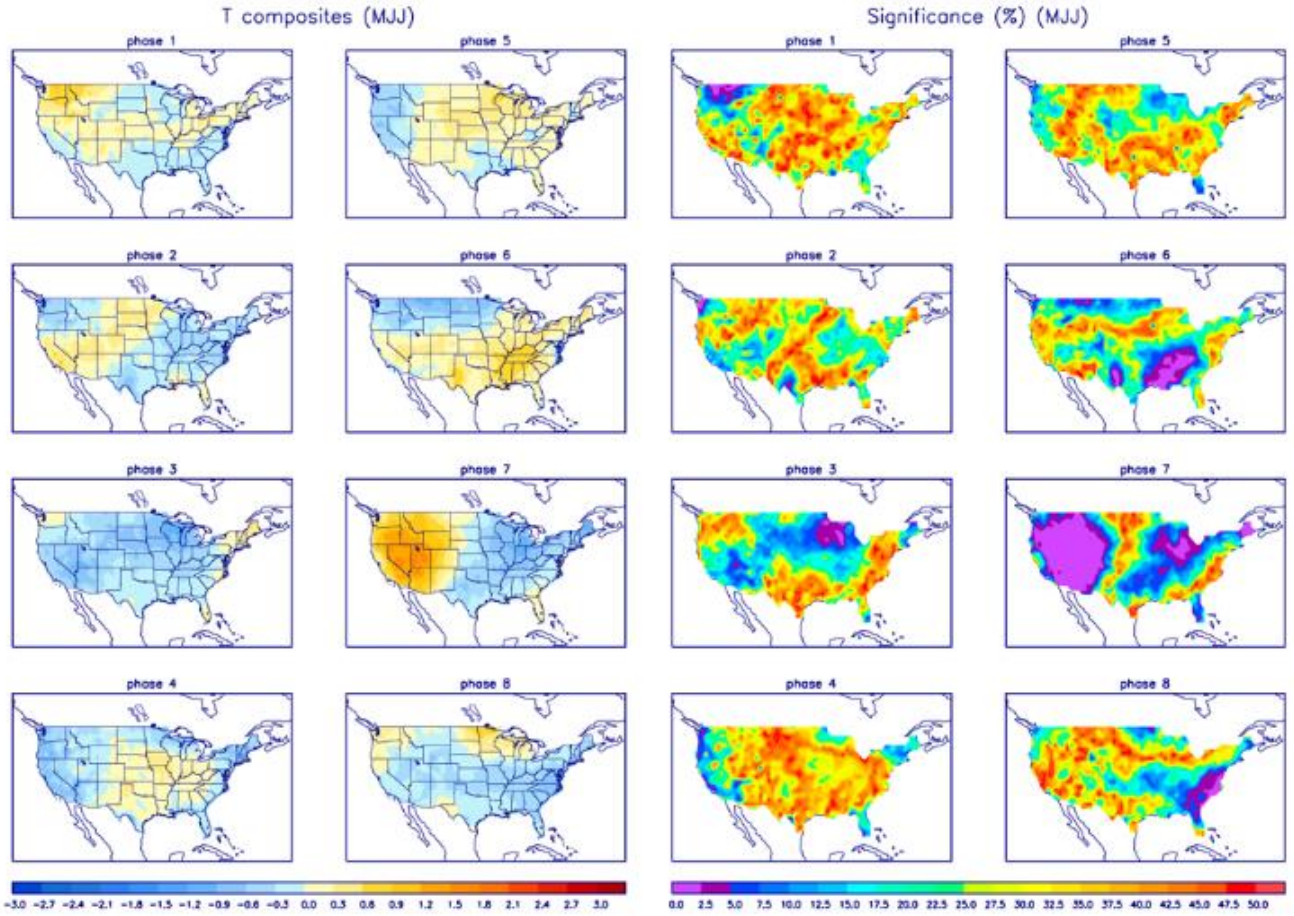
Precipitation Anomalies



MJO: CONUS Composite Maps by RMM Phase - Temperature

Left hand side plots show temperature anomalies by MJO phase for MJO events that have occurred over the three month period in the historical record. Blue (red) shades show negative (positive) anomalies respectively.

Right hand side plots show a measure of significance for the left hand side anomalies. Purple shades indicate areas in which the anomalies are significant at the 95% or better confidence level.

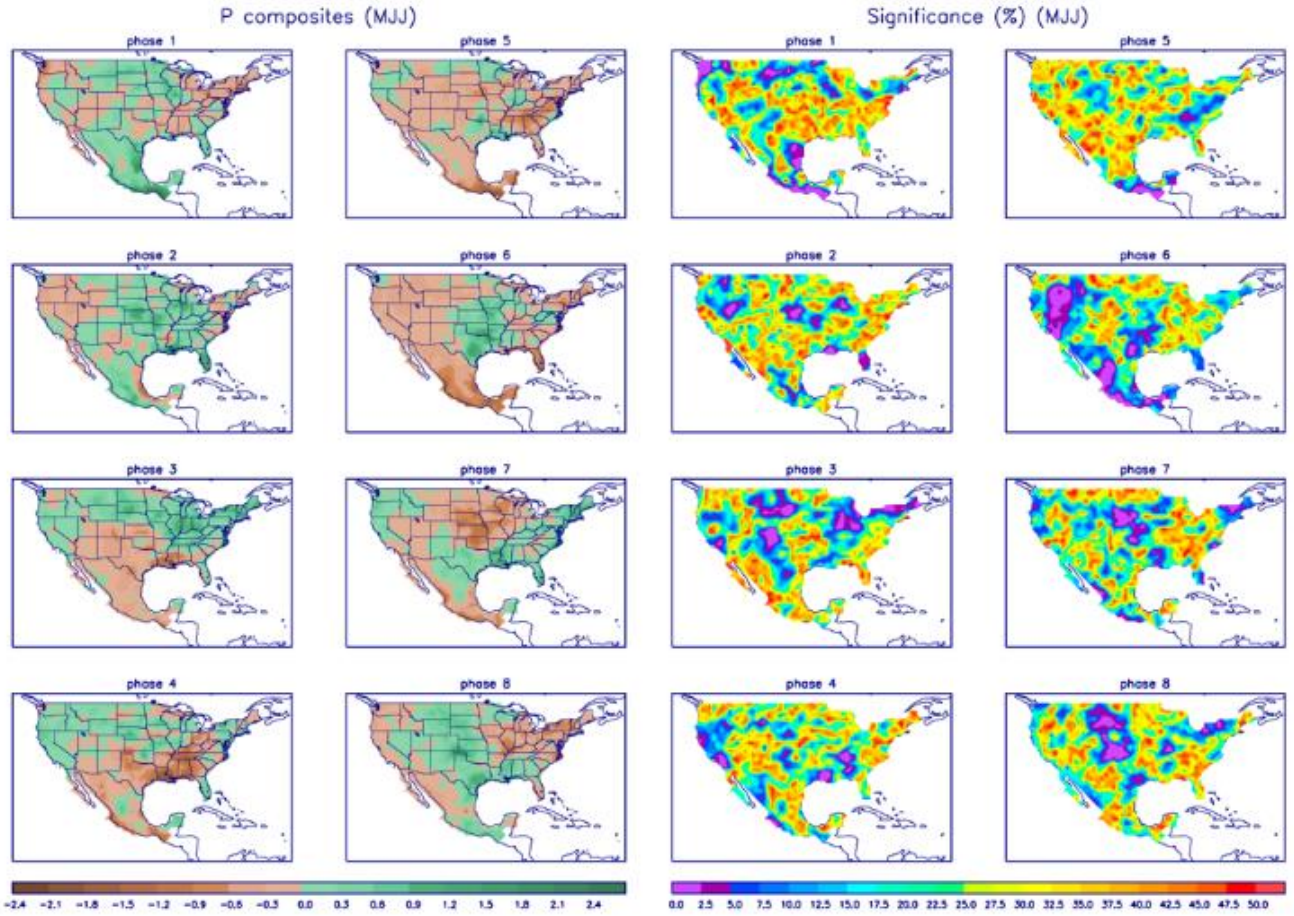


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

MJO: CONUS Composite Maps by RMM Phase - Temperature

Left hand side plots show precipitation anomalies by MJO phase for MJO events that have occurred over the three month period in the historical record. Brown (green) shades show negative (positive) anomalies respectively.

Right hand side plots show a measure of significance for the left hand side anomalies. Purple shades indicate areas in which the anomalies are significant at the 95% or better confidence level.



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